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Journal of Complexity 23 (2007) 421–422

Journal of COMPLEXITY

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Guest Editors' Preface

Issue dedicated to Professor Henryk Woźniakowski

This issue of the *Journal of Complexity* is dedicated to Professor Henryk Woźniakowski on the occasion of his 60th birthday, which was celebrated during the seminar "Algorithms and Complexity for Continuous Problems" at Schloss Dagstuhl, Germany, in Fall 2006.

Henryk has been a dear friend, teacher, mentor, and collaborator for the three of us as well as for many others. This special issue is a small token of our appreciation for all that he has done for each of us individually, for the community at large, and for the whole field of computational mathematics.

For over 30 years, Henryk has been an important player in computational mathematics, as well as a co-founder of *information-based complexity*. He has co-authored three research monographs and written some 150 papers. He has written papers with 34 different researchers from various countries, including Australia, Austria, China, Germany, Poland, and the USA. He was the advisor to 11 PhD students and many more MS students. Henryk was a co-founder of the *Journal of Complexity*, which is currently one of the top applied mathematics and computer science journals on the Thompson ISI Impact Factor list. He is on the Editorial Boards of *Numerical Algorithms and Matematyka Stosowana* and on the Advisory Board of *Foundations of Computational Mathematics*.

Henryk has received a number of awards for his achievements, including two Prizes of the First Degree from the Ministry of National Education of Poland in 1980 and 1989, Research Awards of the Polish Academy of Sciences in 1975 and 1983, the Stanislaw Mazur Award of the Polish Mathematical Society in 1988, the Wladyslaw Orlicz Medal in 2006, and a Humboldt Research Award for 2006–2007.

Describing all Henryk's research contributions would require too many pages. This is why we restrict ourselves to some of the results pertaining to scientific computing and computational complexity.

Over 20 of his papers deal with numerical stability and/or convergence of algorithms for solving linear and non-linear systems of equations. For instance, in the paper that appeared in *Numerische Mathematik* in 1977 he gave a stable version of the Chebyshev method for large systems of linear equations. In 1980, he published in *Linear Algebra and Applications* a result showing that the commonly used conjugate gradient algorithm is unstable; however, it regains numerical stability when complemented by a few steps of iterative refinement. In a number of papers he introduced the very useful concept of *the order of information* of iterative methods for solving nonlinear equations and obtained a number of seminal results on the optimal convergence rate of iterations.

Although the results on iterative methods always addressed cost and optimality questions, Henryk's research moved into the complexity of general problems with his first research monograph,

0885-064X/$ - see front matter
doi:10.1016/j.jco.2007.10.001

A General Theory of Optimal Algorithm co-authored with J.F. Traub, Academic Press, 1980. Among a number of new results, they extended Bakhvalov's result by showing that adaption does not help for linear problems, and characterized optimal algorithms for linear problems defined on Hilbert spaces. This monograph was devoted solely to the worst case setting. Other settings, including average, probabilistic and randomized, were considered in the next two monographs, *Information, Uncertainty, Complexity*, Addison Wesley, 1983, and *Information-Based Complexity*, Academic Press, 1988, both co-authored with J.F. Traub and G.W. Wasilkowski. The monographs presented a number of new results in those settings and motivated people to pursue research in information-based complexity.

Another seminal result appeared in the *Bulletin of AMS* in 1991. Henryk showed that the problem of selecting optimal sampling points for multivariate integration in the average case setting with respect to the Wiener sheet measure is equivalent to the problem of low discrepancy points and the minimal worst case errors of quasi-Monte Carlo methods. This observation was instrumental in renewing interest in quasi-Monte Carlo methods and their applications to problems with a huge number of variables. In 1994, Henryk formalized the concept of tractability of continuous problems. Since then, hundreds of papers have been written on this subject by many researchers from all over the world. Henryk plays the major role in this research area and is the author or co-author of many important and deep results. These findings often provide new efficient algorithms for a variety of problems, including multivariate approximation, integration, and path integrals. Moreover, with collaborators, he has proposed such concepts as weighted spaces, finite-order weights, and generalized tractability, to mention just a few.

Recently, Henryk has also contributed to the relatively new field of numerical quantum computation. For example, he showed that path integrals could be computed faster on a quantum computer than on a classical computer.

In summary, Henryk has made very major contributions to a number of different areas of applied mathematics and computer science and has been the leading researcher in information-based complexity. Numerous conferences and seminars all over the world that he co-organized resulted in the development and popularization of the topic. He has infected many of us with his enthusiasm and interest in continuous complexity. He has befriended and mentored many more; the number of submitted papers to this Festschrift and their scope are clear proof of that.

We thank all the friends who submitted papers. We adhered to the very strict acceptance criteria of the *Journal of Complexity*, which resulted in the rejection of some interesting papers. To avoid a scheduling problem (which, in general, is NP-complete), we decided to present the accepted papers in the order in which they were submitted.

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